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(71) Applicant : **JAMES RIVER CORPORATION**
Tredegar Street P.O. Box 2218
Richmond VA 23217 (US)

(72) Inventor : **Pounder, Joseph R.**
3226 Twin Willow Court
Appleton, Wisconsin 54915-5696 (US)

(74) Representative : **Cropp, John Anthony David**
MATHYS & SQUIRE 10 Fleet Street
London, EC4Y 1AY (GB)

(54) Methods for increasing sheet solids after wet pressing operations.

(57) A method is provided for minimizing the re-wetting of a sheet after wet pressing of the same with a water receiver, the method comprising : forming before or during the pressing together of the sheet and the water receiver, a surfactant laden or foam-filled region at an interface between the sheet and the water receiver ; and separating the water receiver from the sheet after the pressing of the two together. The method allows for the formation of sheets having higher solids after wet pressing.

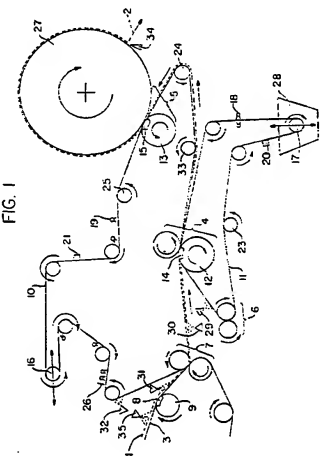

FIG. 1

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BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to paper making processes, wherein an increase in sheet solids is achieved after wet pressing operations bY reducing and preferably minimising sheet rewet after wet pressing operations.

Discussion of Related Art

In U.S. Patent 3,542,640, there is disclosed the application of mechanical pressure to a sheet containing foam to force the drainage of water from the sheet and increase the solids content of the sheet. However, minimizing rewetting of the sheet by creating a region of foam or surfactant is not suggested or envisioned in the reference.

In U.S. Petent 4,062,721, there is disclosed the reduction of water from a wet fibrous sheet by edding a surfactant foaming agent to the fiber furnish and then epplying a vacuum to the sheet to create foam. The increase in air pressure differential across the sheet improves vacuum drainage. There is no suggestion, however, of achieving high solids or minimizing rewetting by creating a surfactant-laden or foam-filled region et the interface between the sheet and the water receiver to inhibit the water from returning to the sheet.

In U.S. Patents 4,606,944 and 4,778,477, there is disclosed the application of foam to a region of a fibrous sheet and the epplication of a pressure gredient to the sheet in the region where the foem was epplied. However, the processes described in both of these patents preferably employ a vacuum to produce the pressure gradient. U.S. Patent 4,778,477, moreover, is directed to facilitating add-ons, such as dyes and the like. Minimizing rewet in the absence of a vacuum by creating a defined surfactant- or foam-containing region is not disclosed or envisioned in these U.S. patents.

U.S. Patents 4,443,296 and 4,543,156 are illustrative of the paper making art relating to the for-mation of sheets from surfactant-foamed fibers. Even so, neither of these patents suggests the creation of a region of foam or surfactant to minimize rewetting.

SUMMARY OF THE INVENTION

The present invention provides a method of reducing, and preferably minimising, sheet rewet after wet pressing, which in turn allows those skilled in the art to also increase the amount of solids in sheets after wet pressing operations.

The inventive methods herein disclioseó, contain the steps of (1) forming before or during the pressing together of a wet sheet and a water receiver, a surfactant-laden or foam-filled region at en interface between the sheet and the water receiver, and (2) separating the water receiver from the sheet after the pressing of the two together.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more fully understood from the detailed description given here and below and the accompanying drawing which is, given by way of illustration only, end thus is not limitative of the resent invention, and wherein:

Figure 1 : Illustrates one currently known method for wet pressing and drying papers, allowing for illustration of certain aspects of the present inventive discovery.

DETAILED DESCRIPTION OF THE EMBODIMENT

The following detailed description is provided to eid those skilled in the art in practicing the present invention. However, the following discussions, including those relating to exemplary embodiments, should not be deemed to unduly limit the present invention. This is particularly important to understand since minor variations and/or changes can be made to the embodiments herein disclosed by those of ordinary skill in the art without departing-from the spirit or scope of the present invention. Moreover, it is noted that the rights of the present inventor to the invention herein disclosed are only limited by the scope of claims eppended hereto and the equivalents thereof.

The present invention provides for methods of preventing sheet rewet occurring after wet processing operations. This in turn also allows the present invention to provide for sheets having increased solids after wet pressing. The methods disclosed herein are applicable to the production of an endless variety of paper and paper type products, including paper towel and tissue like products, among others.

Paper making processes which involve the deposition of aqueous suspensions of peper making fibers on foraminous supports are well known, and moreover, paper making processes which involve the deposition of foamed aqueous suspensions of paper making fibers on foraminous supports are also well known. In each type of paper making process, large volumes of water are utilized to deposit paper making fibers on a suitable support. Likewise, a variety of steps are usually also performed in each type of process to separate the paper making fibers (after deposition) from the aqueous based solutions and foams used to deposit the same.

Methods used by those skilled in the art to separate deposited paper making fibers from aqueous based solutions and foams include gravitional means es well es forced meens such es phase change, vacuuming, wet pressing, etc. Phase change involves

chenging weter which is present into e vapor, and vacuuming involves the creation of a pressure differential across layers of paper making fibers so that water is quickly drained therefrom. Wet pressing operations, on the other hand, generally entail pressing a sheet of wet paper making fibers against e water receiver so that water in the sheet is transferred from the sheet to the water receiver. Wet pressing operations are most often carried out by using felts as water receivers.

Perts of Figure 1 show what may be considered as a typical paper making wet pressing and drying operation, which uses felts as water receivers. Figure 1 at the same time, however, also illustrates many aspects of the present invention.

In a typical paper making process, wet pressing and drying operations are used to convert wet sheets of paper making fibers into dry sheets of a paper product. In Figure 1, these operations are shown in the following manner. A wet sheet of paper making fibers (1) is carried on a forming fabric belt (3) to a couch roller (9), which may have e vacuum zone (8). The vacuum zone of the couch roller operates at ebout e few inches Hg, and serves to remove water which is present in the fabric belt (3) as well as in the layer of wet fibers thereon, so that the layer of paper making fibers only contains about 75 to 90% water, prior to reaching the pick up zone (7) At the pick up zone (7), the wet sheet of fibers is transferred to a felt water receiver (10), and thereefter, the wet fiber sheet can be carried on the felt to an optionel first wet pressing station (4), which contains two press rollers. The first wet pressing station may often contain as a press roller a suction roller, such es (12) with a vacuum zone (14), which operates at ebout 5 to 10 inches Hg. The use of such e suction roller at wet pressing station (4), helps to ensure that the felt water receiver (11) which the roller contacts, remains relatively dry during wet pressing.

After the sheet of paper fibers passes through the optional wet pressing station (4), it continues to be carried on the felt water receiver (10) over guide or turn rollers such as (24) and (33) to a second wet pressing station (5). Wet pressing station (5) contains es one of its pressing rollers a Yankee dryer (27), and as its other pressing roller, a suction roller (13) with a vacuum zone (15). The suction roller (13) operates in similar fashion to the suction roller (12) at wet pressing station (4).

After exiting wet pressing station (5), the paper sheet adheres to the surface of the dryer (27) and is dried (by phase change of water in the paper sheet to a vapor), and after drying, the paper sheet is removed from the dryer. The paper may be removed from the dryer using a creping blade (34), if desired. In any event, there is obtained e dry paper product (2).

A typical wet pressing end drying operation as shown in Figure 1 is continuous and as such, the felt water receivers (10) and (11) used therein must be continuelly conditioned with respect to moisture content so es to properly work throughout a paper production run. In this regard, once e felt has been wet pressed es shown in Figure 1, it is usually showered with water such as shown by (18) and (19), and vacuumed as shown by (20) and (21). The felts can also be press-rolled to condition their moisture content (6), or wiped to condition their moisture content (26). In order to perform such continuous conditioning, the felts run around a variety of guide and turn rolls such as (23) end (25), among others. Further, stretch rollers such es (16) and (17) are used to ensure that the felts ere continually maintained under proper tension for performing a wet pressing of the paper making fibers used to prepare the dry papers (2).

Having provided how Figure 1 shows what is typical of known wet pressing and drying operations, it is now discussed how Figure 1 additionally illustrates certain aspects of the present invention.

The present invention provides for a method of preventing the rewetting of a sheet after a wet pressing of the sheet with e water receiver (such as a felt) by creating a surfactant-laden or foam-filled region at en interface between the sheet and the water receiver, and thereafter, separating the water receiver from the sheet after the wet pressing of the two together. In Figure 1, spray nozzles (29), (30), (31), (32), and (35) are provided as means for applying surfectants or solutions thereof to the wet paper making fibers (1) and/or the felt water receivers (10) and (11). Moreover, a liquid container reservoir (28) is provided as a means of saturating the felt water receiver (11) with a concentrated solution of a surfactant. Any of these means shown in Figure 1 are sufficient for providing a surfactant-laden region at the interface of the paper making fiber sheet (1) end surfaces of felts (10) and (11) that come into contact with (1). It is noted that the means shown in Figure 1 for providing e surfactant-laden region are only exemplary of several which may be utilized, and therefore should not be deemed to unduly limit the present invention.

In order to provide for surfactant-laden regions as herein disclosed, it is considered that any surfactant which can significantly reduce the surface tension of water, and/or will allow water to be foamed, would be useful in the present invention. Exemplary of suitable surfactants to include in the present invention are sodium lauryl sulfate end alpha olefin sulfates and sulfonates preferably having a carbon chain length from 12 to 16, as well as many non-ionic surfactants. Such surfactants are commercially available from a variety of manufacturers.

Whether a surfactant laden region is created by applying a surfactant to the surface of a sheet of paper fibers or to the surface of a water receiver, it is thought that appropriate amounts of the surfactants to apply would be preferably 0.01 to 0.1 g/m^2.

It is elso envisioned herein thet en appropriate surfactant-laden region es provided for herein, can be

created by the eddition of a surfactant to e furnish of peper making fibers. In such an instance, e layer of wet paper-meking fibers such as shown by (1) in Figure 1 would contain a sufficient amount of surfactant so that upon wet pressing of the same with a water receiver like felts (10) and/or (11) there would be created the desired surfactant-laden region at en interface between the paper sheet and at least one of the water receivers. In such an embodiment of the present invention, it is thought that from about 30 to 300 ppm of surfactant in an appropriate liquid dispersion of papermaking fibers would be sufficient for producing a suitable surfactant-laden region, and thus for minimizing sheet rewet after wet processing.

While not specifically shown in Figure 1, the present invention also provides for the use of foam-filled regions which are formed before or during wet pressing at the interface of sheets and water receivers. In this regard, much as in the way surfactants are applied to the wet paper making fibers (1) or felts (10) and (11), foam filled regions can also be applied. For example, headboxes can be used to apply surfactant containing foams to either felt (10) or (11) or to the wet paper fibers (1), shown in Figure 1, if desired. In this regard, it is only necessary that the foam, once applied, creete a foamed region et the interface between the wet paper sheet and e weter receiver pressed there egainst during wet pressing.

It is edditionally noted thet those skilled in the ert mey find it desirable to employ e peper meking foamed furnish in order to creete a suitable foam-filled region between the wet leyer of paper-meking fibers end a weter receiver pressed there ageinst during wet pressing. The use of such a foamed furnish for such a purpose is encompassed hereby.

It is additionally provided herein that foam or surfactant-laden regions may be created, for example, at the interface between the paper sheet (1) in Figure 1 and the felts (10) and (11) during wet pressing of the same. one suitable way to achieve such a foamed filled region during the wet pressing step is as follows. At the wet pressing station (5), one of the pressing rollers is a Yankee dryer (27). If the surface temperature of this dryer is sufficiently high (e.g., at least about 180°F), and the wet papers which are being pressed at station (5) contain or have sprayed thereon compounds which create gases above room temperature (e.g., sodium carbonate, sodium bicarbonate, ammonium carbonate, ammonium bicarbonate, etc.). there can easily be created an appropriate foam-filled region during wet pressing at the interface between the paper sheet (11) and the felt water receiver (10). Even so, et least some surfactant should also be present et the interface so as to assure a proper foam-filled region is produced es gas is evolved from a chosen compound. The use of compounds such as sodium carbonete, etc. to produce e foam by evolution of e gas during wet pressing operations is encompassed hereby.

By creating a surfactant or foam-filled region such as provided for in the present invention, those skilled in the art now have available to themselves means for minimizing rewetting of paper layers after wet pressing steps, and thus they elso possess means for increasing the solid contents of paper sheets efter wet pressing since less water is present in the layers after wet pressing. This minimization of sheet rewet is thought to be brought about by the surfactant and foam-filled regions ebility to control wicking of water from the water receivers (to the paper sheet) following their wet pressing against surfaces of the paper sheets. Control of such wicking is also aided in the present invention by providing that after wet pressing, the water receivers are separated from the paper sheets. In this regard, in Figure 1 it is noted that felt (11) is immediately separated from the paper following wet pressing, and felt (10) separates from the paper sheet after the wet paper's journey to wet pressing station (5). It is further noted that in commercial paper making machines, paper making speeds of 5,000 fpm are easily achieved, and therefore the amount of time the wet paper (1) would be expected to be in contact with felt (10), between wet pressing stations (4) and (5), is minuscule et best.

In order to show the effectiveness of the present inventive methods in minimizing sheet rewet and increesing sheet solids efter wet pressing, severel experiments were performed end are described below.

High speed experiments were carried out which involved edding an elphe olefin sulfonete surfectant by spraying a water solution of the surfectant onto the weter recovery felts of en apperatus similar to thet shown in Figure 1. Addition rates were from 0 grams of surfactant/meter^2 of felt surface (i.e., no surfactant, just water sprayed) up to 0.076 grams of surfactant/meter^2 of felt surface. Papers were produced at machine speeds of 4000 and 5000 fpm. It was found that by increasing the surfactant addition rate in such experiments, there was also always an increase in the emount of pressing solids in the paper sheets produced.

In other experiments, paper sheets were produced at speeds up to 4000 fpm from a slurry of fibers having an alpha olefin sulfonate surfactant added to create a foamed furnish. Surfactant concentration was about 250 ppm. Wet pressing solids were always higher than those from non-foamed slurries at equivalent machine conditions.

The above results clearly evidence thet with the present inventive discovery, those skilled in the art may now minimize sheet rewet occurring after wet pressing operations, end in turn increase sheet solids efter such wet pressing.

The invention being thus described, it will be obvious that the same may be veried in many ways. Such variations are not to be regarded as a departure

from the spirit and scope of the invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

Claims

1. A method of reducing the rewetting of a sheet after a wet pressing of the same with a water receiver, characterised in that the method comprises:
   forming before or during the pressing together of the sheet and the water receiver, a surfactant-laden or foam-filled region at an interface between the sheet and the water receiver; and
   separating the water receiver from the sheet after the pressing of the two together.

2. A method as claimed in claim 1, characterised in that the water receiver is a felt.

3. A method as claimed in claim 1 or claim 2, characterised in that a surfactant-laden region is created at the interface between the sheet and the water receiver and said surfactant-laden region contains a surfactant which can lower the surface tension of water.

4. A method as claimed in any one of claims 1 to 3, characterised in that the surfactant-laden region contains an alpha olefin sulfate or sulfonate surfactant.

5. A method as claimed in claim 4, characterised in that the surfactant is an alpha olefin sulfonate having a carbon chain length from 12 to 16.

6. A method as claimed in any one of claims 1 to 3, characterised in that the surfactant is sodium lauryl sulfate.

7. A method as claimed in any one of claims 1 to 6, characterised in that the surfactant in the surfactant-laden region is applied to a surface of at least one of said water receiver and said sheet before wet pressing the water receiver with the sheet.

8. A method as claimed in claim 7, characterised in that the surfactant in the surfactant-laden region is applied to the water receiver by placing the water receiver in a solution of the surfactant.

9. A method as claimed in claim 1 or claim 2, characterised in that a foam-filled region is created at the interface between the sheet and the water receiver and said foam-filled region contains a surfactant.

10. A method as claimed in claim 9 characterised in that the foam-filled region contains a surfactant which can lower the surface tension of water.

11. A method as claimed in any one of claims 1, 2, 9 and 10, characterised in that the foam-filled region contains a foamed furnish of paper making fibers.

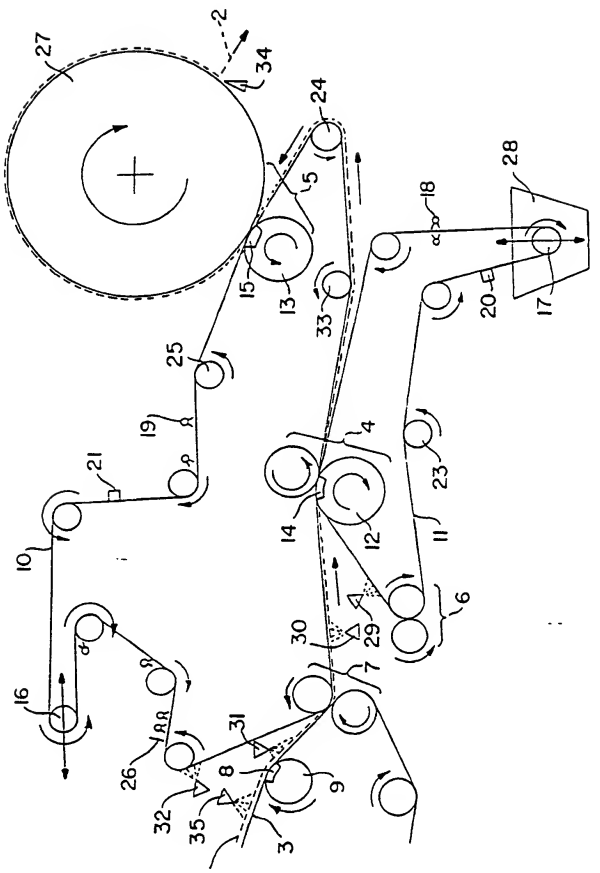
12. A method as claimed in claim 11, characterised in that the foam furnish is deposited on the water receiver.

13. A method as claimed in any one of claims 1, 2 and 9 to 12, characterised in that said foam-filled region is created when a .compound that is in the sheet or water receiver, or on the sheet's surface or water receiver's surface, gives off a gas.

14. A method as claimed in claim 13, characterised in that said compound is sodium carbonate, sodium bicarbonate, ammonium carbonate or ammonium bicarbonate.

15. A method as claimed in any one of claims 1 to 14 wherein said sheet comprises paper making fibers.

FIG. 1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European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 30 4095

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	WO-A-8 806 656 (PAPER CHEMISTRY LABORATORY) * the whole document *	1-3,7,8, 15	D21F11/00
X	WO-A-8 403 112 (SCOTT PAPER) * the whole document *	1-3,6,11	
D,X	US-A-4 606 944 (LAUCHENAUER) * the whole document *	1-3,7,9, 10	
A	US-A-3 798 122 (APPEL) * the whole document *	1,9-12, 15	
A	WO-A-8 805 100 (USG INTERIORS) * the whole document *	1-5	
A	GB-A-1 118 045 (KALLE) * the whole document *	1,9-12, 15	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	GB-A-2 091 305 (DAVID EDWARD WILLIS)		D21F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	07 AUGUST 1992	DE RIJCK F.

CATEGORY OF CITED DOCUMENTS

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